

ABSTRACT

The present invention provides a design of a horn for vibration actuators. In general a driving actuator generates vibrations and a horn amplifies the vibration amplitude where the amplification is related to the ratio between the surface area of the horn at the contact with the actuator and the tip surface. The acoustic path of existing direct horn designs is modified to adopt at least one change in direction, or fold, so as to produce a compact design. Preferably there are three parallel, concentric, acoustic paths and two folds. A second embodiment has an internal horn that is concentric and internal to the actuator. A third embodiment uses a tubular horn where an electroactive stack is encircled by the horn. The device may have a hollow core for the transfer of materials from one side to the other. The addition of the folds to the horn allows for the introduction of constructive bending vibrations that can be used to enhance the amplification or to alter the phase of the vibration, and therefore provide an additional degree of freedom in the design of horns. The object of this invention is to provide for the design of compact configurations of vibration mechanisms, which are lightweight, compact and can be manufactured with a minimum of waste during fabrication.